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Shrews (Mammalia: Soricidae) from a Bronze Age deposit in Cyprus, with the description of a new subspecies

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Abstract. Shrews are described from a Bronze Age deposit at Kouklia, Cyprus. The *Crocidura* of this sample is compared to an undated Holocene sample (from Cape Pyla) and to the living *Crocidura suaveolens cypria* Bate, 1903. The Kouklia and Cape Pyla material is here described as *C. s. praecypria* nov. subsp.; the main difference to the living *C. s. cypria* is the significantly smaller size of the fossil material. In addition, *Suncus etruscus* was found in the Kouklia sample.

Key words. Mammalia, Soricidae, Cyprus, archaeozoology, taxonomy, island evolution.

Introduction

Descriptions of small mammals from archaeological deposits in the Mediterranean islands are quite scarce. This is regrettable, since data obtained from archaeozoological studies may give important clues to the understanding of the recent zoogeography of the islands. Man, especially from prehistoric and classical times, played a crucial role in the extermination of the endemic (Pleistocene) island faunas and their replacement by the set of vertebrates that comprises the fauna of today. As the strata in archaeological deposits are usually well-dated, the faunas found associated can give information about possible dates of extinctions and introductions.

As far as shrews are concerned, material has so far been studied from archaeological deposits from Menorca (Reumer & Sanders, 1984; Sanders & Reumer, 1984) and from Crete (Payne, in press; Reumer & Payne, 1986). Studies of small mammal faunas with Soricidae from less well-dated Holocene sediments are known from Chios (Besenecker et al., 1972) and from Majorca (Reumer, 1980).

Many more small mammal faunas from islands are yet to be studied. One of the present authors (UO) has been able to obtain a small sample of Soricidae from the archaeological site of Kouklia in Cyprus. This enabled us to study the Cypriot shrew faunule from the time of deposition (13th—12th century B. C.), and to compare it with the recent fauna.

In addition, we had the opportunity to study a small sample of (sub?)fossil *Crocidura* from a karstic deposit in Cyprus.

It is quite insufficiently known whether, and if so, to what extent, shrews were present in Cyprus during the Pleistocene, as they were in, for example, Crete (Reumer, 1986). Some indications were published by Boekschoten & Sondaar (1972), who stated that "Some teeth of a soricid were found in the Kythraea basin deposits, which were not identifiable to the generic level" (o. c., p. 332). This observation was based on records from two Cypriot localities, Dikomo Mandra and Kythraea. Bate (1903)

was noted to have found "mouse (two shrew skulls)" in Dikomo Mandra in 1902 (Boekschoten & Sondaar, 1972, p. 316), while the latter authors stated about Kythraea: "The residual contained some teeth of murids, insectivores (. . .)" (o. c., p. 321).

The material collected by Boekschoten and Sondaar is stored in Utrecht (Institute of Earth Sciences, Palaeontology Dept.). There are, however, no shrews in the material they collected from Kythraea. There are a few teeth from bats that might have been mistaken for shrew-material (one chiropteran lower molar is of about the same size as *Crocidura* and possesses a myotodont morphology, in which the hypolophid continues behind the entoconid, so that confusion with a soricid tooth seems likely).

Fortunately, we found a small sample in the Utrecht Cyprus collection with about a dozen teeth from a locality at Cape Pyla, most probably Ayii Saranta (Sondaar, pers. comm.). Boekschoten & Sondaar (1972) noted: "Farther to the east we visited (. . .) Ayii Saranta, where we collected hippopotamus teeth and rodent remains" (o. c., p. 324).

The description of the shrews from an archaeological level in Kouklia, and its comparison with the (sub)fossil material from Cape Pyla and with the recent *Crocidura suaveolens cypria* forms the subject of the present paper.

Material and methods

Kouklia: The small mammal remains studied originate from the contents of a nearly completely preserved storage vessel (a so-called pithos). The vessel was found in an impression cut into the rock, in the hall of the Temple of Aphrodite. The contents were dated to the Late Bronze Age, 13th—12th century B. C.; this date was confirmed by finds of sherds inside the vessel.

Our Kouklia material consists of several dozen mandibular and maxillar remains. The material was already cleaned when provided, but, when necessary, it has been treated with a weak solution of acetic acid (ca. 5 %) in order the remove adhering sediment. It was subsequently hardened with a plastic solution in acetone. The material is stored in the collection of Mr. Urs Oberli, with the exception of the holotype and a representative mandible (the paratype) of *Crocidura suaveolens praecypria* nov. subsp., which are in the collections of the Natuurmuseum Rotterdam, The Netherlands (NMR).

Cape Pyla: we also studied the above-mentioned small collection of shrew teeth from the fossiliferous deposits at Cape Pyla (probably Ayii Saranta). This material was collected in 1969 by Drs. P. Y. Sondaar and G. J. Boekschoten and it is stored in the collections of the Institute for Earth Sciences (IvAU) at Utrecht. See Boekschoten & Sondaar (1972) for locality details. Only detached teeth are available: 2 I, 1 A, 2 P4, 1 M1, 2 M2, 2 i, 2 m1, 1 m3, 13 elements altogether.

Recent material: for comparative purposes, we studied the skulls of 26 recent *Crocidura suaveolens cypria*, that are in the collections of the Institut de Zoologie et d'Ecologie Animale (IZEA) at Lausanne. They originate from Prodhromos (nos. IZEA X61, X179, X187 through X 196, X198, X199 and 1665); from Laxia (nos. IZEA X175, X177, X203—205); and from Limassol (no. 1445).

Measurements of the material were made using a Leitz Ortholux microscope fitted with a movable stage and measuring clocks. The results of the measurements are presented in tables 1—4. The parameters measured are according to Reumer & Payne (1986), partly after Vesmanis (1976). The abbreviations used in the tables for the parameters are: ZW = zygomatic width; PE = length to the posterior emargination; LL = lingual length; BL = buccal length; L = length; W = width; AW = anterior width; PW = posterior width; TRW = trigonid

width; TAW = talonid width; L+i = length of the mandible including the lower incisor; L—i = the same but excluding the incisor; LC = length of the mandible over the condyle, excluding the incisor; HC = coronoid height; HUS = height to the upper sigmoid notch; LLF = length of the lower condylar facet; CL = condylar length; CH = condylar height; CW = condylar width. Upper dental elements are indicated with capitals (I, A, P, M), lower elements with lower cast (i, a, p, m,).

The calculations for establishing the significance of differences between the samples are done using the Student's t-test after Simpson et al., 1960. Results are given in table 2.

The drawings of figures 1, 2 and 3 were made using a Wild M5 with a camera lucida attachment.

Description of the material

A. The material from Kouklia

Suncus etruscus Savi, 1822
(table 1)

A few remains (only mandibular fragments and lower dentition) of *Suncus etruscus* are found in the Kouklia sample. There is no morphological difference between our material and material from the archaeological deposits described from Crete, or recent samples (see Reumer & Payne, 1986 and table 1 of this paper). Considering the small size of the samples studied, the differences seen in the measurements cannot be considered as being significant.

Table 1: Measurements (in mm) of *Suncus etruscus* from Kouklia. In all tables prm = parameter, n = number of observations, min = smallest observation, max = largest observation, X = mean of the observations, sd = standard deviation. For an explanation of parameters see the text.

prm	n	min	X	max
TRW m1	1		0.63	
TAW m1	1		0.71	
L m1	1		1.05	
TRW m2	3	0.57	0.59	0.62
TAW m2	3	0.63	0.64	0.65
L m2	2	1.01	1.02	1.02
W m3	3	0.44	0.45	0.45
L m3	3	0.77	0.80	0.86
L i—m3	1		4.99	
L m1—m3	1		2.50	
LC	1		6.25	
HC	2	2.86	2.89	2.91
HUS	2	1.47	1.50	1.52
LLF	2	0.82	0.84	0.86
CH	2	0.85	0.87	0.88
CL	2	1.23	1.28	1.32
CW	2	0.50	0.52	0.54

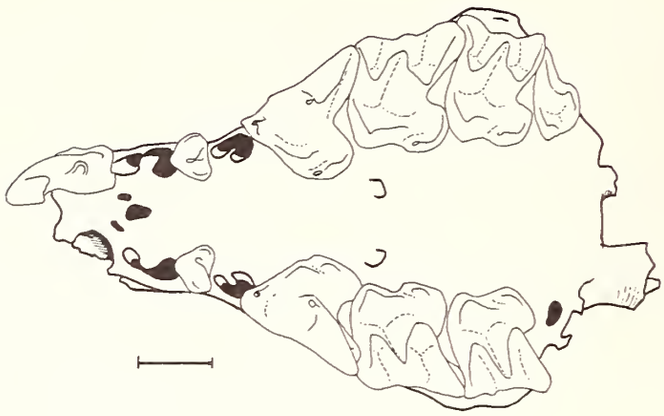

Fig. 1: Holotype of *Crocidura suaveolens praecypria* nov. subsp., a rostrum in ventral (occlusal) view, coll. NMR. Bar indicates 1 mm.

Crocidura suaveolens praecypria nov. subsp.
(figures 1, 2, 3, table 2)

Holotype: a rostrum bearing right A2, P4, M1, M2 and left I, A2, P4, M1, M2 and M3, coll. NMR; figure 1, in addition both its P4's are depicted in fig. 3 (e, f).
Paratype: a left ramus with complete dentition, coll. NMR; figure 2.
Locus typicus: Kouklia, Cyprus.
Stratum typicum: Holocene (Bronze Age).
Derivatio nominis: from *prae*, before, and *cypria*, the subspecies presently living, which itself got named after Cyprus.
Diagnosis: a relatively small *C. suaveolens*; A1 considerably larger than A2 and A3; P4 with the protocone situated away from the antero-lingual corner and separated from the hypocone by a wide valley; m3 with a basined talonid and often a rudimentary entoconid.
Differential diagnosis: *C. s. praecypria* can be distinguished from *C. s. cypria* by its significantly smaller size; from other subspecies of *C. suaveolens* by its possession of a basined talonid in m3, next to its confinement to Cyprus.
Description in addition to diagnosis: We do, unfortunately, not have a complete series of upper antemolars (AA sup.). The available material only allows to conclude that A1 has been considerably larger than A2 and A3; these latter two elements do not appear to have differed much in size.

The morphology of P4 (fig. 3a—g) is somewhat variable. In general though, the protocone is placed well away from the antero-lingual corner of the tooth. There is a clearly developed separating groove or valley between the protocone and the hypoconal ridge. A distinct hypocone cannot be observed on this ridge; the hypoconal flange is relatively small. The parastyle is small and pointed; a parastylar crest can be seen but it is low and insignificant.

The third lower molar (fig. 3h) is noteworthy in that it does not normally have the unicuspid talonid that is so characteristic for *Crocidura*. Instead, a more or less clearly discernable talonid basin is present in most specimens. In a few specimens even a rudimentary entoconid can be observed.

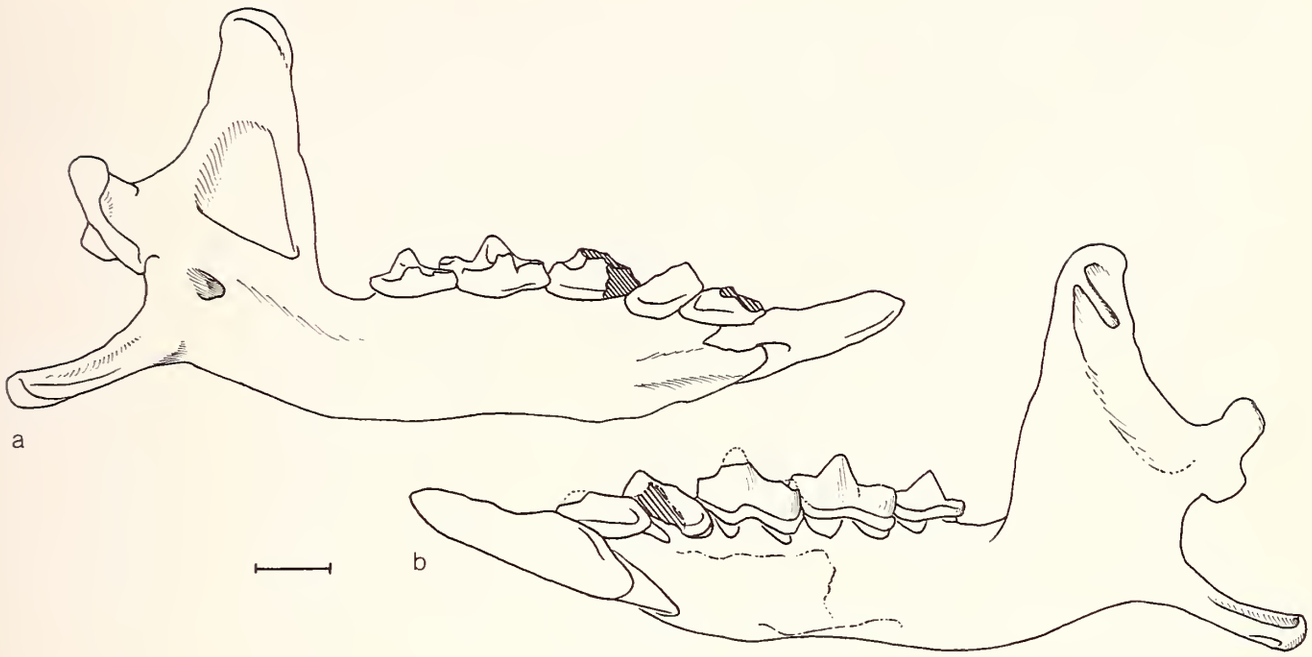

Fig. 2: Paratype of *Crocidura suaveolens praecypria* nov. subsp., a left ramus in medial (lingual) view (a) and lateral (buccal) view (b), coll. NMR. Bar indicates 1 mm.

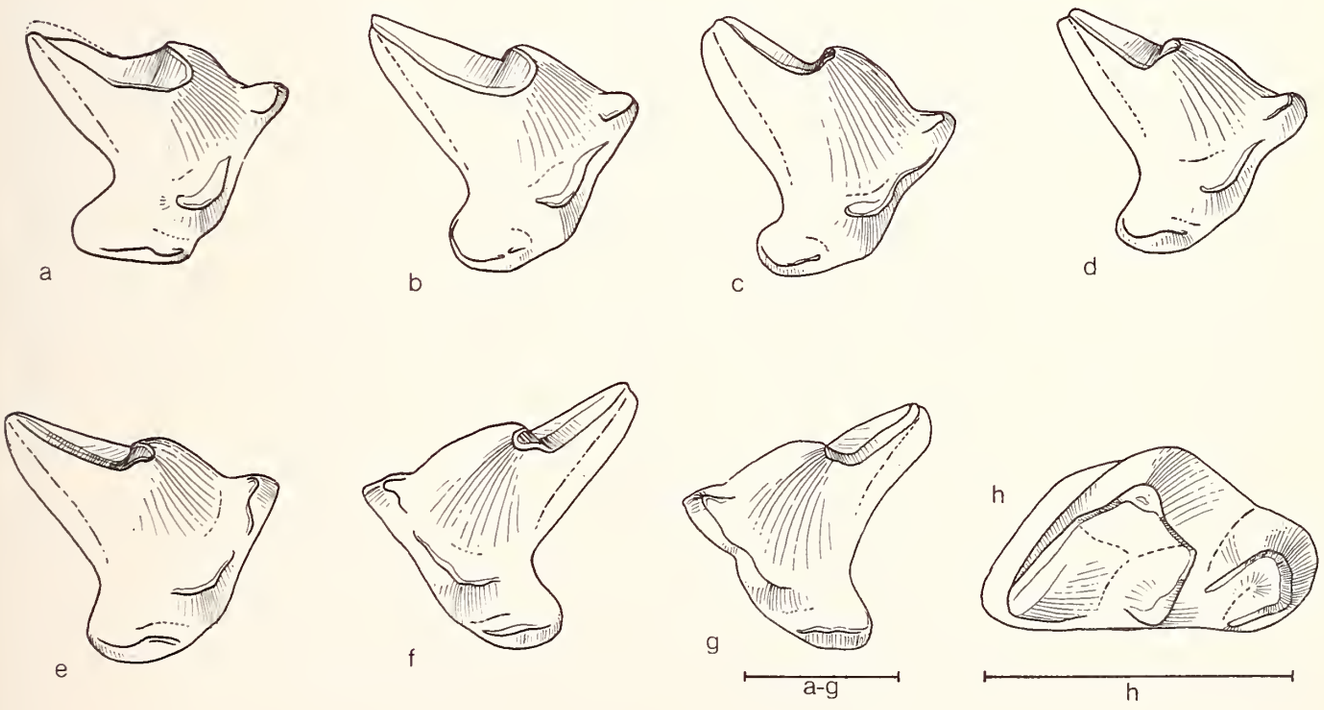

Fig. 3: *Crocidura suaveolens praecypria* nov. subsp.
a—g: P4's from Kouklia, showing the buccally situated protocone and the low and separated hypoconal ridge. Specimens e and f belong to the holotype.
h: an m3, also from Kouklia, showing the basined talonid. Bars indicate 1 mm for the indicated specimens.

Table 2: Measurements (in mm) of *Crocidura suaveolens praecypria* from Kouklia. Abbreviations see Table 1. In the column "sig" (= significance) is indicated whether the present data differ significantly from the data of recent *C. s. cypria*, as given in Table 4. — = no difference; + = difference at the $p < 0.05$ level; ++ = at the $p < 0.001$ level.

prm	n	min	X	max	sd	sig
ZW skull	1		5.25			
PE P4	8	0.78	0.89	1.01	0.071	—
LL P4	8	0.86	0.95	1.06	0.075	—
BL P4	8	1.64	1.71	1.76	0.039	++
W P4	8	1.26	1.38	1.47	0.068	++
PE M1	10	0.93	0.98	1.02	0.030	++
LL M1	9	1.22	1.26	1.32	0.036	++
BL M1	9	1.21	1.38	1.48	0.076	++
AW M1	8	1.45	1.51	1.58	0.050	++
PW M1	7	1.78	1.84	1.93	0.046	+
PE M2	7	0.91	0.94	0.97	0.021	++
LL M2	6	1.09	1.18	1.27	0.073	+
BL M2	5	1.15	1.18	1.21	0.023	++
AW M2	5	1.58	1.68	1.80	0.081	+
PW M2	4	1.44	1.51	1.57	0.060	+
L M3	1		0.61			
W M3	1		1.12			
TRW m1	24	0.81	0.89	0.96	0.038	++
TAW m1	24	0.89	1.00	1.07	0.046	+
L m1	21	1.38	1.45	1.53	0.039	++
TRW m2	22	0.79	0.85	0.90	0.031	++
TAW m2	22	0.84	0.89	0.95	0.033	++
L m2	22	1.30	1.39	1.47	0.048	++
W m3	17	0.56	0.60	0.65	0.024	++
L m3	18	1.02	1.08	1.15	0.037	++
L i—m3	3	7.06	7.11	7.21		
L m1—m3	12	3.42	3.61	3.83	0.125	++
LC	3	9.10	9.26	9.40		
HC	9	4.07	4.32	4.63	0.172	—
HUS	11	2.11	2.23	2.43	0.094	++
LLF	9	1.14	1.23	1.32	0.060	++
CH	9	1.12	1.31	1.50	0.123	+
CL	10	1.73	1.88	2.06	0.103	++
CW	9	0.79	0.86	1.01	0.072	++

B. The material from Cape Pyla

Crocidura suaveolens praecypria nov. subsp.
(table 3)

The material from the fossiliferous deposits at Cape Pyla is here also identified as belonging to *C. s. praecypria*.

Table 3: Measurements (in mm) of *Crocidura suaveolens praecypria* from Cape Pyla. For abbreviations see Table 1.

prm	n	min	X	max
PE P4	2	0.89	0.93	0.96
LL P4	2	0.99	1.01	1.02
BL P4	2	1.75	1.75	1.75
W P4	2	1.38	1.41	1.44
PE M1	1		0.96	
BL M1	1		1.35	
PE M2	2	0.88	0.90	0.91
LL M2	2	1.12	1.15	1.17
BL M2	2	1.14	1.15	1.16
AW M2	2	1.61	1.64	1.67
PW M2	2	1.41	1.42	1.43
TRW m1	2	0.80	0.81	0.82
TAW m1	2	0.86	0.87	0.87
L m1	2	1.44	1.45	1.46
W m3	1		0.57	
L m3	1		1.05	

The protocone of P4 is placed far away from the antero-lingual corner of the tooth; it is separated from the hypoconal ridge by a wide valley. A distinct hypocone is not discernable. The parastyle of P4 is small; there is hardly a parastylar crest.

There is only one m3 in the sample. It shows the presence of a talonid basin. A chip is broken off at the place where the entoconid could sit; it can thus not be checked whether the tooth had a (rudimentary) entoconid, as is often the case in the material from Kouklia and the recent specimens (see below), or not.

In general, as far as can be judged with so little material, there appears to be a striking resemblance of the Cape Pyla material with that from Kouklia; the measurements (table 3, fig. 4) do not suggest otherwise, hence the identification as *C. s. praecypria*.

Discussion

Table 4 gives the measurements of recent *C. s. cypria*. In table 2 we have indicated the parameters that show a significant difference between Kouklia and the recent material. As can be seen, for most parameters both samples differ significantly at a probability level of $p < 0.001$; some others differ still at $p < 0.05$. In figure 4 we have scattered the relation between length and trigonid width of the m1 from both samples as well as from Cape Pyla. The difference between the subfossil samples and the recent one is easily observed.

The recent *Crocidura cypria*, which was described by Bate in 1903 as a subspecies of *C. russula*, has been shown to belong to the species *C. suaveolens*, albeit as a subspecies only distantly related to the subspecies on the mainland (Catzeflis, 1983;

Catzeflis et al., 1985; Vogel et al., 1986). With this conclusion in mind, the material from Kouklia and Cape Pyla, showing considerable morphometric distinction from the extant *cypria*, cannot be described but as a subspecies of *suaveolens*. As we feel that *cypria* has derived directly from the subfossil shrew (the close relationship being shown by the unique feature of the talonid basin in m3), we have proposed the name *C. suaveolens praecypria*. Although we realize that living populations of *C. suaveolens* may even have smaller dimensions than *C. s. praecypria*, we feel that the m3 justifies the description of a new taxon.

Table 4: Measurements (in mm) of recent *Crocidura suaveolens cypria* from Cyprus. For abbreviations see Table 1.

prm	n	min	X	max	sd
ZW skull	26	5.62	5.89	6.28	0.184
PE P4	52	0.70	0.85	0.99	0.059
LL P4	52	0.76	0.93	1.10	0.061
BL P4	52	1.69	1.84	2.00	0.070
W P4	52	1.33	1.49	1.70	0.076
PE M1	52	0.98	1.12	1.28	0.057
LL M1	52	1.28	1.43	1.60	0.067
BL M1	52	1.38	1.50	1.61	0.055
AW M1	52	1.46	1.62	1.80	0.080
PW M1	52	1.74	1.95	2.13	0.094
PE M2	52	0.91	1.01	1.12	0.044
LL M2	52	1.13	1.24	1.34	0.058
BL M2	52	1.20	1.29	1.41	0.052
AW M2	52	1.61	1.80	1.96	0.074
PW M2	52	1.46	1.60	1.75	0.088
L M3	52	0.59	0.68	0.79	0.043
W M3	52	1.12	1.30	1.43	0.071
TRW m1	52	0.86	0.94	1.05	0.043
TAW m1	52	0.95	1.04	1.15	0.048
L m1	52	1.43	1.61	1.77	0.079
TRW m2	52	0.82	0.89	0.97	0.031
TAW m2	52	0.83	0.93	1.00	0.038
L m2	52	1.40	1.51	1.67	0.056
W m3	52	0.60	0.67	0.75	0.034
L m3	52	1.09	1.17	1.27	0.046
L i—m3	52	6.99	7.60	8.09	0.248
L m1—m3	52	3.64	3.89	4.21	0.117
L +i	52	11.36	12.21	13.19	0.420
L —i	52	9.45	10.15	10.94	0.344
LC	52	9.22	9.82	10.47	0.294
HC	52	4.18	4.55	4.90	0.181
HUS	52	2.14	2.36	2.53	0.101
LLF	52	1.16	1.37	1.54	0.082
CH	52	1.19	1.40	1.62	0.094
CL	52	1.76	2.06	2.33	0.091
CW	52	0.83	0.97	1.16	0.075

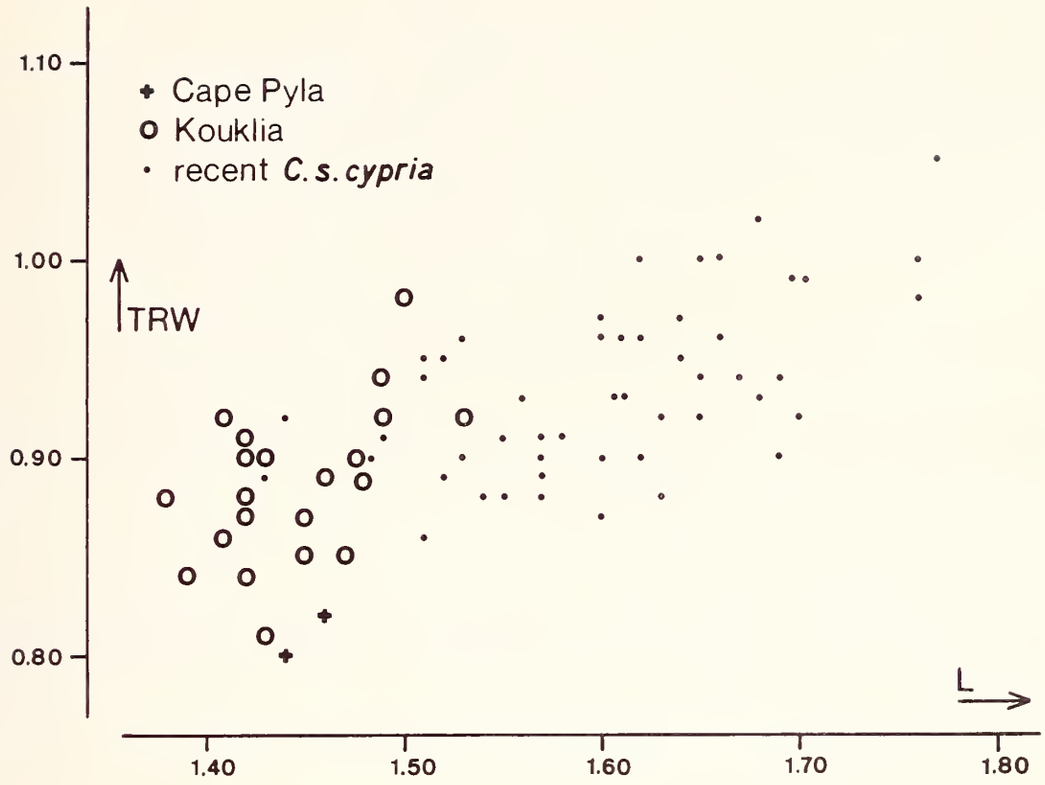

Fig. 4: Scatter diagram of the relation between trigonid width (TRW) and length (L) of the m1 in *Crocidura suaveolens praecypria* and in recent *C. s. cypria*. Units are in mm.

The presence of living Soricidae in Mediterranean islands can be explained in two ways, (a) the species have been present during at least most of the Pleistocene and since, or (b) the species were originally absent, but got introduced by man. Model (a) has been shown to have occurred in Crete (Reumer, 1986), model (b) holds true for most other islands, such as Ibiza, Menorca, Corsica, Sardinia. In case (a) we would expect the animals to be quite unrelated to the living mainland taxa; this is indeed the case in Crete, where *C. zimmermanni* has no close relationship to either *C. russula*, *C. suaveolens* or *C. leucodon* (three species that settled in Europe in the late middle or late Pleistocene). The fact that the living *C. s. cypria* belongs to a species that abounds in the mainland, suggests that the animals might have been introduced by man. The presence of *C. s. praecypria* in an archaeological context does not falsify this hypothesis. This would also imply that the age of the Cape Pyla fossils postdates the human conquest of Cyprus. Vogel et al. (1986) noted a relatively large biochemical distance between *C. s. cypria* and *C. suaveolens* from the Turkish mainland. On the other hand, *C. suaveolens caneae* from Crete shows no appreciable distance from the Turkish *C. suaveolens* (*C. s. caneae* became introduced before 1500 BC). This could either mean that the (as yet undated) introduction of *C. suaveolens* onto Cyprus took place long before the introduction onto Crete, or that the origin of *praecypria/cypria* does not lie in Turkey but elsewhere in the eastern Mediterranean region.

The observed increase in size in the lineage *praecypria — cypria* corroborates the general trend in insular small mammals; the time-span involved (c. 3000 yrs) shows the rapidity at which such development can take place.

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Prof. P. Vogel provided the recent comparative material; Dr. P. Y. Sondaar allowed us to include the Cape Pyla sample in the present study. Prof. Vogel and Dr. J. de Vos critically read the manuscript and gave helpful comments. Most of the work was done in the framework of the first author's voluntary affiliation to the Institute for Earth Sciences at Utrecht University.

Zusammenfassung

Es werden die Spitzmäuse aus einer bronzezeitlichen Fundstelle bei Kouklia, Zypern, beschrieben. Die *Crocidura* werden mit holozänem Material von Cape Pyla und mit rezenten *Crocidura suaveolens cypria* Bate, 1903 verglichen. Das Material aus Kouklia und Cape Pyla wird hier als eine neue Unterart, *C. s. praecypria* nov. subsp., dargestellt; der wichtigste Unterschied zu der rezenten *C. s. cypria* ist die wesentlich kleinere Größe der fossilen Unterart. Außerdem wurde *Suncus etruscus* in Kouklia gefunden.

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